900 feet high. Something similar is well known to the inhabitants of Arequipa, Peru. The city is built at the base of the extinct volcano "Misti," which rises above the plaza of Arequipa to a height of about 12,500 feet; Arequipa itself being over 7,000 feet above the level of the sea. It is not an uncommon occurrence (during the fall of the year, February and March) in the morning, from sunrise till about ten o'clock, to see a succession of clouds rolling along the summit from N.E. to S.W., much as if huge masses of white smoke were issuing from the extinct crater. These clouds are either suddenly shot upward by meeting the current from the S.W. and lost at a distance of from 30,000 to 40,000 feet to the eastward from the summit, or else, rolling over the summit, they are carried by the easterly breezes till they become absorbed by the dryer and warmer air of the region to the southward of Misti.

It must be remembered that between Arequipa and the sea, at a distance of not more than thirty miles, extends the great sandy desert of Islay, having an average breadth of about twenty-five miles, and before the days of the railroad the great terror of all travellers from the sea-coast to the interior. Of course the winds blowing across this desert (a part of the great rainless belt

of Peru) are greatly heated at all seasons of the year. The eastern slope of Misti, on the contrary, forms the edge of the elevated plateau extending for more than 150 miles to the eastern slope of the Andes, having an altitude of from 10,000 to 14,000 feet, and the amount of rain falling in this district is very great.

The formation of the cloud, seen from Arequipa on the summit only of Misti, is plainly seen from the railroad leading to Puno, which, after leaving Arequipa, makes a gigantic sweep northward round the Chacharni Mountains, and winds its way eastward behind Misti at a height of about 12,500 feet above the level of the sea. There I have several times seen masses of vapour, condensed into huge white clouds rolling along the slopes of Misti, travel up with great rapidity towards the summit, and either follow its crest as described above, or become at once reabsorbed on reaching the top. This shows plainly that the clouds seen from Arequipa are not due to volcanic action; the Indians also all agree in stating that there is no tradition among them of Misti having been active. I enclose a sketch of Misti and its cloud from a photograph obtained during my visit to Peru.

ALEXANDER AGASSIZ

Cambridge, Mass., Nov. 6

The Effect of Waves

IT is generally believed that at a moderate depth the influence of heavy waves ceases, and that during a hurricane all is quiet a few fathoms beneath the surface. If this be correct, why should a swell show such a marked increase in height when it rolls over the edge of soundings?

On the parallel of Cape Clear, in longitude 15° W., seamen are familiar with this phenomenon, although the depth is nearly five hundred fathoms; at times it is so marked that the dead reckoning may be checked by carefully noting the increase in the depth of the hollow of the waves. Shortly after the edge of soundings is passed the sea becomes more regular, and consequently less dangerous to deeply laden vessels.

Anyone who has watched during a moderate breeze the commotion of the water close to a quay wall can form a good idea of the ocean when it receives its first check against the Irish Plateau; the great waves twist around each other, run up and down in heaps, and then fall suddenly as if bereft, in a great measure, of their forward motion.

Again, it is a well-known fact that during a "norther" in the Gulf of Mexico the frailest vessels weather out the storm if they can cross the edge of the Campeachy Banks; a striking proof that at a depth of over fifty fathoms there is sufficient abrasion to destroy the force of the heaviest wave in a very effectual style. On one occasion the writer witnessed this remarkable fact by running from a turbulent sea into comparative smooth water in this locality.

On George's Shoals, off Nantucket, during a heavy gale, the New York pilots and masters of coasting vessels assert that sand is frequently left on deck after a sea has broken on board, although the depth of water may be twelve or fourteen fathoms. It must require an enormous amount of ebullition at the bottom to raise such dense matter to the surface through such a distance; for a cubic foot of ordinary sea-sand weighs about 100 pounds.

In this wild spot the tide, which frequently runs with a velocity of three miles per hour, would assist the lifting power of the wave if running counter to it. During a winter gale, when the strong springs are thus running, the confusion of the sea is indescribable, although the depth may be thirty fathoms. The shortness of the sea (*i.e.* the distance between the crests of the waves) on the banks of Newfoundland, where the soundings are from thirty to fifty fathoms, is noticed by all the navigators of the Western Atlantic, as it reduces the speed of an ocean steamer more than the heavier waves of deeper water with a similar force of wind will do. It is evident that this can only arise from the friction of the bottom, as the waves increase in height when deeper water is reached a short distance to the eastward.

In the Gulf Stream north of the Straits of Bemine, after a "norther" has blown a few hours, the surface of the sea is covered with lanes of weed, although only a few patches might have been seen before the commencement of the gale. As these lanes are often at a considerable distance from shoal water, which lies at right angles to the direction of the current and wind, it is evident they must have grown near the spot where they float, and been torn from their moorings by the mechanical force of the waves.

W. W. KIDDLE

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF 1605, Oct. 12.—Clavius, observing the solar eclipse of April 9, 1567, at its maximum, remarked "a narrow ring of light round the moon which he supposed to be the margin of the solar disc." Kepler, however, maintained that this could not be in reality a portion of the sun, because the moon's apparent diameter at the time must have been greater than that of the sun, and he concluded, as Prof. Grant relates in his "History of Physical Astronomy," that the sun must have been totally covered by the moon while the narrow ring of light was visible, a phenomenon again exhibited in the total eclipse of Oct. 12, 1605, which was observed at Naples. Of this eclipse Kepler says (De Stella Nova in pede Serpentarii)—"Accuratè rectum fuisse totum Solem, quod quidem non diu duraverit; in medio, ubi Luna, fuisse speciem quasi nigræ nubis; circumcirca rubentem et flammeum splendorem, æqualis undique latitudinis, qui bonam cœli partem occupaverit: E regioni Solis, versus Septentrionem, cœlum obscurum planè, et cum profunda nox est; stellas tamen non visas."

Adopting the same system of elements of the lunar motions, employed in previous calculations of past eclipses, the results of which have appeared in this column, we have the following elements of the eclipse to which Kepler refers:—

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Conjunction in R.A. Oct. 12, 1605, at 0h. 31m. 44s. G.M.T.			
R.A.	197°	41′	51″
Moon's hourly motion in R.A.		35	37
Sun's ,, ,, ...		2	19
Moon's declination	6	40	28 S.
Sun's ,, ...	7	31	33 S.
Moon's hourly motion in Declination ...		10	50 S.
Sun's ,, ,, ,, ...		0	56 S.
Moon's horizontal parallax		59	21
Sun's ,, ,, ...			9
Moon's true semi-diameter		16	10·4
Sun's ,, ,, ...		16	3·9

The sidereal time at Greenwich mean noon Oct. 12 was 13h. 24m. 10·9s., and the equation of time 13m. 29s. additive to mean time. The eclipse would be total and central with the sun on the meridian, in longitude 11° 18′ W., and latitude 52° 26′ N. For Naples, a direct calculation gives a total eclipse, the sun at an altitude of 31°. Beginning of totality at 2h. 18m. 18s., ending at 2h. 19m. 28s., mean time at Naples, or duration 1m. 10s., which appears to correspond fairly with Kepler's statement that the sun was "covered for a short time" only.

THE MINOR PLANETS.—M. Stephan, Director of the Observatory at Marseilles, announces the discovery of another small planet by M. Borelly, on December 1. Right ascension at midnight, 65° 31′; north polar distance, 66° 2′; motion towards north-east, thirteenth magnitude. Supposing all the recently detected minor planets to be new, this will be No. 157. The last circular of the "Berliner Astronomisches Jahrbuch," however, has a suggestion by Prof. Tietjen that No. 152, discovered by M. Paul Henry at Paris on November 2, may prove to be the same planet which was found by M. Borelly, 1868, May 29, and which received the name Dike. No. 152 passed the ascending node soon after noon on November 3, the geocentric longitude at the time being 41° 54′, and it was not far from opposition, which is so far favourable to the supposition of identity with Dike, with ascending node in 41° 50′ according to the most probable orbit that could be obtained from the short course of observations in 1868. Dike was estimated of thirteenth magnitude, yet in 1868 was observed within 10° from perihelion; in ascending node the planet would be less than 29° from aphelion; No. 152 is called eleventh magnitude, a difference, considering the respective orbital positions, which is adverse to identity. The unfavourable weather has prevented observations sufficient for a proper calculation of elements for No. 152. Should this planet prove to be identical with No. 99 (Dike), the numbers from 153 onwards will of course require to be diminished by one, and the actual number of small planets, including M. Borelly's late discovery, will stand at 156.

*THE MAMMALS OF YARKAND**

THE unfortunate death of the lamented naturalist, Stoliczka—one of the most promising members of the Indian Geological Survey—must be fresh in the memory of many of our readers. After a successful campaign in Yarkand in company with Sir D. Forsyth's late expedition, he did not live to return to India, but perished of exhaustion amongst the snows of the Himalayas. We are pleased to hear that his Indian friends have undertaken the preparation of a work intended as a memorial of him, which will embrace an account of the extensive collections of natural history amassed during his last journeys. Mr. W. T. Blanford has just issued a preparatory list of the mammals of which specimens were obtained in Yarkand and the adjoining countries. They are referable to forty-two species, mostly belonging to groups characteristic of the elevated districts of the Palæarctic region. No new types were discovered, but amongst the novelties are species of Field-voles, Hares, and Pikas (*Lagomys*), all very distinctive of the regions traversed by the expedition, and adding largely to our knowledge of the fauna of Western Tibet and Eastern Turkestan. The larger mammals were originally better represented, but after Dr. Stoliczka's death, many specimens appear to have been removed from the collection. Of a fine series of twenty-two wild sheep from Kashgar, only eleven are now left, and not one of these has fine horns. Moreover there remain skeletons of wild sheep and ibex in the collection, of which the heads have entirely disappeared. Mr. Godwin Austen has invited public attention to these unpleasant facts in another column of this journal. One would have supposed that in the case of a naturalist thus perishing in the performance of his arduous duties, no pains could have been too great to protect the specimens in procuring which he had sacrificed his life. On the contrary, however, advantage appears to have been taken of his untimely death to rob his collection of the choicest specimens. We can only trust that, attention having been called to the fact, restitution will be made, and the missing heads and horns promptly restored to the mutilated specimens now deposited in the Imperial Museum at Calcutta.

* "List of Mammalia collected by the late Dr. Stoliczka when attached to the Embassy under Sir D. Forsyth, in Kashmir, Ladák, Eastern Turkestan, and Wakhau, with descriptions of new species." By W. T. Blanford, F.R.S., F.Z.S. (Journ. As. Soc. Bengal, vol. xliv. p. 105, *et seqq.*)

ARCHÆOLOGICAL RESEARCHES IN KENTUCKY AND INDIANA

IN January last Mr. Putnam laid before the Society of Natural History of Boston, U.S., an extended account of his recent archæological researches in Kentucky and Indiana, in which he had examined several rock-shelters, caves, mounds, and circular graves. He called attention to the numerous ancient fortifications in the Ohio valley, and gave a description of two which he had visited in Indiana. These fortifications are generally earthworks, many of them of great extent; but there have been several discovered in which immense walls of stone have been used, extending in one case to several hundred feet in length, and to nearly ten feet in height; whilst in another instance a wall about seventy-five feet in height had been erected to fill a gap in the otherwise nearly precipitous natural wall. The stones of these walls were simply laid, one overlapping another, so as to break joints, without cement of any kind. Mr. Putnam exhibited to the meeting a number of human skulls and other bones found under various conditions, and pointed out that while the skulls of the New England Indians were long and narrow and belonged to the *dolichocephali*, those from the mounds, the circular graves, the stone graves, and the caves were of the short, broad and high type, or the *brachicephali*. In the caves, however, there were two, if not three, classes of burials, and at least two well-marked forms of skull. The skulls he found in graves protected with slabs of stone were all of a form very closely resembling the high, short and broad crania of the mound builders; those of the numerous skeletons from the caves were characterised by the marked depression of the frontal bone and the equally marked concavity on the anterior part of the parietals; and the skulls from the circular graves were distinguished from the others by their decided width and shortness, and the more vertical occipital portion.

A series of shin-bones was also exhibited to show the various degrees of flattening, and to confirm the opinion of Mr. Busk and others that *platycnemism* cannot be taken as an important race character.

Of a number of circular graves which formerly existed on a hill near Glasgow, one, having escaped the plough, had been carefully opened. It was a circle about four feet in diameter, and had been dug to a depth of three feet, where a floor had been formed with pieces of shale brought from a distance of about a quarter of a mile

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